Prioritizing Foreign Military Engagements: A Multi Objective Decision Analysis Using Value Focused Thinking

Graduate Research Paper

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Abstract

The purpose of this research is to develop a tool to advise and inform Air Force Senior Leadership when prioritizing military engagements with foreign partners. As the defense budget contracts and military personnel diminish in number it will become more important than ever to carefully prioritize the expenditure of valuable resources. Cuts will be made in the Security Cooperation realm despite its level of importance in a new world where the U.S. hopes to shift some international security burden to coalition partners. This paper uses a Multiobjective Decision Analysis with a Value Focused Thinking methodology to create a model which reduces subjectivity in the decision-making process of prioritizing foreign military engagements.

The model is built using an Excel-based Hierarchy Builder add-on using input from SAF/IA and OSD Policy leaders to expose and weigh the many factors which comprise the value of a foreign military engagement. The tool provides a quantitative score and depicts the comparative results graphically which makes the end product easily absorbed by Senior Leaders and communicated to external agents.

I dedicate this work to my wife and children for their support and understanding during this past year.

Acknowledgments

I would like to thank Dr. Stephen Chambal for his professional guidance and additional instruction on the methodologies necessary to complete this research. I would also like to thank Dr. Jeffery Weir for the use of his Hierarch Builder and instruction on its use. Without his program and assistance the model developed would not have been possible. Additionally, I thank Col. Richard "Casper" Pearcy for his extensive support and assistance in access to information and senior leaders necessary for this course of study. Finally, I would like to thank Niall Branigan, Lt Cols Chritopher Nemeth and Neal Newell, and Major Eric Bucheit, all who contributed to my research in a significant manners.

<div align="right">Erik G. Brine</div>

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I. Introduction

General Issue

Foreign military engagement has long been recognized as an important factor in achieving national objectives in the international realm. Since World War II, the United States has recognized the crucial role the military can play in international relations by employing various means of security cooperation. Whether it is through military to military training, exercises, personnel exchanges, the sale or grant of weapons, or even the joint employment of forces, the Department of Defense and service components have perhaps been the United States' most effective emissaries of national influence.

Over the past ten years, based largely on the wars fought and the way in which they were prosecuted, the military has taken on an even larger role in foreign engagement. In both Iraq and Afghanistan, the U.S. recruited partners and led coalitions in an unprecedented manner. This strategy required a vast network of relationships and agreements to manage. To this end, the DoD has participated in tremendous engagement efforts to incentivize and facilitate participation with many nations and build or expand relationships with many others. Obviously, extensive cooperation was needed to develop tactical and operational relationships with countries participating in kinetic operations, but that was only the beginning. Significant cooperation with countries not actively participating was still needed for many reasons. Both combat areas of responsibilities (AORs) required access to basing locations in the region and access via air, ground, and sea for supply lines to support the fight. Additionally, the Global War on Terrorism

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(GWOT) was not limited to the borders of Iraq and Afghanistan nor was it limited to the region or even CENTCOM's AOR. To combat terrorism worldwide, relationships needed to be built in the Horn of Africa and countries in the Pacific where Al Qaeda training camps were growing. In North America relationships with Canada and Mexico needed attention to close gaps in border security. All over the world, intelligence sharing agreements and assets were needed to track and identify terrorists who claimed no one country home and moved often to avoid detention. The scope of operations was and remains enormous and therefore considerable investments still need to be made across the globe.

Today, the landscape has shifted once again. Since 2001, the Defense Budget has grown to over $550 billion annually, with some years requiring supplemental war funding of up to an additional $200 billion to prosecute the wars in Iraq and Afghanistan (Bumiller and Shanker, 2012:A12). Now, as those conflicts come to a close and the United States clings to a fragile recovery from recession, the country has begun refocusing on its economic security. In doing so, spending in all areas of government must be reigned in and budgets across the board will be cut, to include that of Defense. Over the next ten years, DoD is expected to cut $487 billion from its budget (Whitlock,2012). Along with these cuts will be the drawdown of forces and therefore the drawdown of capabilities, at least in some areas. One of those areas is sure to be international security cooperation, but that does not suggest that DoD foreign military engagement will be less important; in fact the exact opposite , as Chief of Staff of the Air Force, Norty Schwartz advises (Schwartz, 2012).

…through activities such as expanded dialogue, combined training and exercises, and practical cooperation, we stand to deepen and broaden our strategic partnerships, making them even more comprehensive and mutually valuable. Grounded in common interests, these partnerships in turn bring people and even entire nations closer together, helping to bolster security ties, increase capacities, and focus future cooperative efforts that rally around newfound collective capabilities. In a time of continued fiscal austerity, these efforts will be even more crucial for their potential to improve efficiency, contain costs, and consolidate capabilities toward mutually beneficial effects, because under current economic circumstances, it is less likely that any single one of us will become a truly full-service, all-inclusive, completely autonomous air force. Rather, as we have done in the new Defense Strategic Guidance, even we are prioritizing according to current trend indicators, anticipated demand signals, compressed budgets, and the most likely of future contingencies.

Problem Statement

In the coming years, resource constraints will limit the level of military foreign engagement the Department of Defense and the service components can conduct compared to that of the last decade. Retrograde from Iraq and Afghanistan will greatly diminish the opportunities to conduct joint, multi-national operations on a regular basis. The end to both wars will mean the U.S. no longer requires such a substantial footprint overseas, especially in the CENTCOM AOR. Once troops and equipment are brought home or to acceptable staging areas, supply lines will shorten, forward operating locations will shutter and day to day contact between U.S. and foreign military forces will end in many countries. Once this occurs, how does the DoD maintain the relationships it has built, the interoperable capability it has achieved with coalition partners, and the access it has secured around the globe? The simple answer is that it cannot, so what should it do? Prioritize!

Over the past ten years, from 2001-2011, a larger U.S. military force, and more of them overseas than in decades, meant more opportunities to engage with foreign

militaries in a meaningful way. Countries willing to support U.S. war efforts provided

motivation for DoD increased assistance to partners. Expanding legal authorities, such as

"1206 Programs" introduced in the 2006 National Defense Authorization Act, authorized

new ways to conduct security cooperation and support operational requirements of

warfighters engaged in combat (Calfee, 2012:4). These programs expedited investment

in foreign offensive, defensive or support capabilities. Even then, when U.S. Defense

spending exploded to $550 billion a year, there were still limitations to what could be

done to assist and engage with foreign partners. The fact of the matter is that DoD and

the services have been prioritizing all along. The difference in the future will be that the

cut line is now much higher up the list. Since far fewer requests will be met and

engagements supported, prioritization will be more important than ever.

Prioritizing security cooperation engagements is a difficult task based upon many

subjective decisions made by senior leaders throughout government organizations and

agencies. Can a tool or process be created to more objectively inform DoD leaders as

they seek to prioritize foreign military engagements in a budget and resource constrained

environment?

Research Objectives

This research project will attempt to create a tool which will provide decision

makers with an objective recommendation when comparing similar foreign engagements

in order to prioritize security cooperation resources.

The tool should:

1 – generate a quantitative outcome

2 – be applicable and useable with a variety of security cooperation engagements

3 – consider criteria deemed appropriate or relevant by the decision maker

4 – create data which can be manipulated to provide a visual depiction of the results

Research Focus

While it is expected that the tool developed will be flexible and exportable to the many different organizations and agencies within DoD which manage or conduct foreign military engagements, this project will focus on engagements common and of importance to the Office of the Deputy Under Secretary of the Air Force for International Affairs, SAF/IA. In this same respect, the tool will be developed based upon factors valued by both SAF/IA and the Office of the Secretary of Defense for Policy, OSD/P.

Investigative Questions

- What factors or criteria deem a foreign engagement important?

- Is it possible to use strictly objective criteria to compare like engagements?

- Can individual factors effectively be assigned differently weighted values and if so can objectivity remain?

Methodology

The method used to develop this tool will be a Multi Objective Decision Analysis (MODA) using Value-Focused Thinking (VFT). The intent is to dissect the very complicated decision of prioritizing foreign military engagements and segment it into a group of more simplified categories or objectives; thus making the overall recommendation a product of the many simplified decisions. VFT is used to determine

each objective's relative importance to other objectives. Additionally, criteria are established to score each individual objective. Groups may be composed of subgroups and complexity grows as the model does, but as long as the model remains consistent, scoring will remain consistent when comparing like engagements.

A hierarchy program built in Microsoft Excel by Jeffery D. Weir, Ph.D., Associate Professor of Operations Research, at the Air Force Institute of Technology at Wright-Patterson Air Force Base, OH, will be used to construct the model and develop the tool to compare engagements.

Assumptions

Input will be taken from leaders and members of SAF/IA and OSD/P and used to create the list of objectives and their relative weights or importance. For the purpose of this project it will be assumed that the senior leader intending to use the tool has approved the objectives and weights assigned to each.

Limitations

Due to the classification of some information used to score certain objectives or measures, some objectives or measures may be intentionally omitted to keep this paper unclassified. These objectives and measures can be easily be added to the tool after completion, based upon an organization's needs, with little effort, but will obviously limit its distribution and raise the classification of the tool to the level of information it contains. In many cases, the objective or measure is not classified, but the score or rating of a partner nation based upon that objective or measure is classified. Therefore, once the

tool is built, this paper will compare three fictitious partner nations using the model developed to analyze its effectiveness as a decision making tool.

Implications

The intent of developing this MODA tool is to add greater objectivity to a decision that is highly subjective. As budgets shrink there will be fewer assets available for leaders in SAF/IA, throughout the Air Force, and DoD. This model will be created with the type of security cooperation engagements most prevalent in the Air Force and supported or managed by SAF/IA in mind, to include Foreign Military Sales (FMS), Excess Defense Article Grants (EDA Grants), the Military Personnel Exchange Program (MPEP), military exercises, bi-lateral/ multi-lateral engagements, senior leader visits, and air shows. The tool will be most effective when it is used to compare like engagements and create a prioritization of an asset or capability, but that is not to say it cannot be effective in comparing the importance of two different types of engagements as well.

Adding a MODA tool to a process like this may be helpful in two important ways. First, using the tool helps the group and /or leadership make a more fully informed decision. Running the MODA engagement model on every FMS case on the list ensures that a standard minimal level of effort is provided on preparing analysis on each case. This prevents cases from sliding to the bottom of the list solely because the individuals representing those cases are absent, quiet, less competent, or less influential. By comparing all the cases by the same standardized set of objective criteria, a clearer picture is gained by all members and leadership. The model will provide a score which is a natural starting place when comparing cases and a graphical representation of the score

will easily depict the differences between two or many cases that are vying for priority. This information could easily be made available to all attendees prior to the meeting which would likely make these meetings both shorter and less contentious. Two things everyone is always looking for in a meeting.

Next, and equally important, using the tool is especially important when decisions need to be exported out of or above the organizations that they are made in. In the case prioritization meeting example, whether everyone agrees or not, everyone understands why a case was given its priority. Once that decision moves on to another organization, most of that justification is lost. Even if the decision is exported with justification, it will normally be with a few bullets or sentences explaining why that case is important or why it is more important than a competing case. If the MODA tool is used the justification is already there, quantified and graphically displayed. The explanation provided will still be necessary and informative, but the use of the tool in this way will instill confidence in the recipient, that the organization made its prioritization decision based on a process of professional rigor. Simultaneously, the scoring and graphical depiction will make the prioritization decision easy to understand and compare for someone not intimately familiar with the details of the partner or engagement.

II. Literature Review

Chapter Overview

The purpose of this review is to identify resources and methods which will be useful in creating an objective tool to for DoD organizations to prioritize foreign military engagements. It will consider current processes by which DoD organizations rank partner countries or military to military events. Then, consider methodologies which may be appropriate for analyzing available information and using senior leadership input to develop a model which is useful.

Partner Ranking Resources

Currently, the manners in which most prioritization decisions are made are highly qualitative. Major stakeholders and leaders will meet or teleconference, prepared with justification to argue for the importance of their desired engagements. A perfect example of this is the FMS Case Prioritization Meeting. At this regularly scheduled meeting/teleconference, representatives from SAF/IA, AFSAC (Air Force Security Assistance Center), and AFSAT (Air Force Security Assistance Training) will meet to identify the top twenty FMS cases currently being developed by Air Force personnel for foreign partners. There is no definition per say of what moves a case to the top of the list, but it is well understood that several factors are particularly important; who the partner is, what the monetary value of the case is, the whose attention the case has, what the political implications of the case are, and what type of equipment or training the case is for. At the meeting the group will work off of the previously prioritized list and work

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their way down starting at the top. Anyone can recommend a change to the current order and discussion will follow. Arguments will be made for and against priority and once consensus is reached, the group will move on. If general consensus is not reached the ranking member from SAF/IA will make a decision and the group will then move on. Empirical data is certainly shared in terms of case value, number of equipment pieces or aircraft to be sold, number of people to be trained, and perhaps time elapsed or remaining to case finalization (priority may often be driven by a cases status if it is behind schedule or overdue to a country).

This type of process is similar to most other engagements that require prioritizations. Many of these prioritized lists do not have the same level of visibility by senior leadership or don't take as much input from external organizations as the FMS Case Prioritization List does at SAF/IA, but the priority lists for Military Personnel Exchanges, which countries AF and DoD senior leaders should visit, and even which countries should be visited by the Thunderbirds on their biennial overseas air show tours are assembled in relatively the same manner.

Another way organizations attempt to prioritize engagements is strictly by ranking the importance of the partner nation. This is done in several different ways based upon different metrics.

Guidance for Employment of the Force (GEF) – Is a classified document which provides military leadership comprehensive, near-term planning guidance along with the Joint Strategic Capabilities Plan (JSCP). It supplies Presidential and Secretary of Defense (SECDEF) politico-military guidance. The President approves the contingency planning

guidance contained in the GEF and approves the Secretary's issuance of the GEF. The GEF is informed by the Unified Command Plan (UCP) and National Defense Strategy (NDS); and it informs strategic policy guidance, campaign plans, and the JSCP. The GEF prioritizes foreign partners by identifying them as Global Core Partners, Key Supporters, Critical Regional Partners, and Priority End State Supporters.

DoD 5230 Low Observable (LO) and Counter Low Observable (CLO) – Is a classified product and process by which certain technology is deemed suitable to sell or transfer to other countries. Upon request by a government agency, a partner will be assessed and tiered according to the findings of the process.

Interagency Country Risk Assessment (ICRAS) – Is a confidential interagency process through which the credit risk associated with U.S. credit assistance to foreign countries is assessed periodically. An interagency group chaired by OMB uses common standards for country risk assessment to rate countries on a scale of A to F- on the basis of economic and political variables.

Master Country Weapons Tiering – Is a classified product developed and maintained by SAF/IA's Weapons Division, IARW. It is a country tiering system based upon a score developed by combining information from a list of sources to include: the GEF, DoD 5320-28, Common Defense Treaties, partner joint combat or exercise activity with U.S. forces, partner operation of U.S. made major defense equipment, U.S. Combatant Command Operations Plans, National Geospatial-Intelligence Agreements, Communications and Information Security Agreements (CISMOAs), General Security of Military Information Agreements (GSOMIAs), and more.

While all of these products are useful in some way, none of them could be used to prioritize a list of engagements to be accomplished, primarily because all of them are built solely upon events or information that occurred in the past. Often times the importance of an engagement is based on current events, new developments, creating access, building a relationship, or seizing future potential, all of which are forward looking. For this reason it simply does not make sense to base prioritization decision making on historical data. These products may provide useful information and should be taken into consideration when making engagement decisions, but alone should not be use to set priorities for the future.

Model Development Methods

Since the previously discussed method of tiering does not seem sufficient to solely support the decision making of future engagement priorities and the approach of setting priorities based upon input provided in a meeting lends itself susceptible to the dangers of inconsistency and groupthink, perhaps a better method could be employed. Multiobjective Decision Analysis (MODA) – is an approach to decision making that suggests that decisions should be made strategically, by following a formal decision making process which will lead to a quantitative result. This process clarifies the elements of a decision, improves decision making and aids in the communication of a decision. (Kirkwood, 1997: 3) This method focuses on the alternatives which exist within a decision and recognizes that choosing different alternatives leads to an overall different decision. This method employs a hierarchy, as seen in figure 1, to map the objectives and delve into the separable components of each objective.
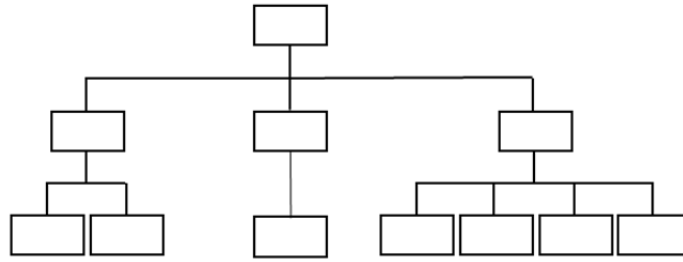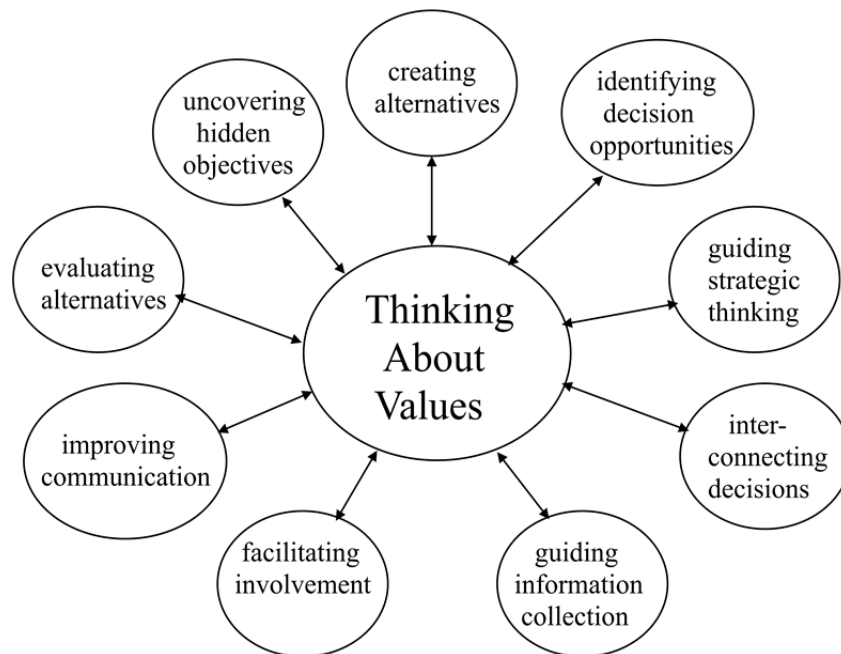
Figure 1 – Objective Hierarchy

There are two common ways in which to approach a Multiobjective Decision Analysis, through Alternative Focused Thinking or Value Focused Thinking. Each has their merits, but which is appropriate is based primarily on the decision to be made and whether the alternatives are known or set at the outset.

Alternative Focused Thinking – is appropriate when the alternatives are already defined. Kirkwood, in his book, "Strategic Decision Making", refers to this as a bottom-up approach. This approach would not be entirely inappropriate to use when comparing foreign military engagements because when attempting to prioritize any list the alternatives are defined. The problem is that this approach only works until the alternatives list expands or changes in some way. In order to be consistent, it may be better to first determine what is ideal, then compare alternatives to that ideal in order to prioritize them.

Value Focused Thinking (VFT) – is used to cast a wider net than Alternative Focused Thinking by first asking what is desired, then figuring out how to get it (Keeney, 1992: 4). Kirkwood considers this the top-down approach; first determining what the overall objective is, then developing evaluation considerations to provide detail to those objectives. This approach starts with the decision maker rather than alternatives and

develops the hierarchy based upon what is important to the decision maker. This allows for greater objectivity. By subsequently developing a set of values and measures which can be used to score every alternative, VFT addresses what structural components of an alternative are important, before even looking at an alternative. The benefits of VFT described by Keeney in his book, "Value Focused Thinking" are depicted in figure 2.

Figure 2 - Benefits of VFT (Keeney, 1992:24)

Summary

In order to attempt to improve on the current process used to prioritize foreign military engagements in SAF/IA, a Multiobjective Decision Analysis hierarchy using Value Focused Thinking will be used to develop a model to incorporate objectives now used in tiering methods with newly created objectives which are forward looking. This model will then be available to serve as a tool in the decision making process of

prioritizing like engagements. Combining MODA and VFT will combine the

hierarchical benefit of closely examining the components of each alternative, while

employing the top-down importance assigned to each objective by decision makers.

III. Methodology

Chapter Overview

      This chapter will describe the decision analysis process of developing a MODA hierarchy using VFT as it is employed by Dr. Stephen Chambal at the Air Force Institute of Technology. The process is built largely on the concepts of Craig Kirkwood and Ralph Keeney from their previously mentioned writings on MODA and VFT respectively. The focus of this chapter will be on describing the steps involved in building the hierarchy model, defining terms used in the model, then employing it as it pertains to the problem at hand, prioritizing foreign military engagements, using a Microsoft Excel based Hierarchy Builder program developed by AFIT professor, Dr. Jeffrey Weir with input provided by senior leaders in SAF/IA.

Hierarchy Model

      Before getting into the process, it is first important to understand the components terms used in and associated with the hierarchy model. Figure 3 below provides a basic hierarchy example and a few definitions will follow.
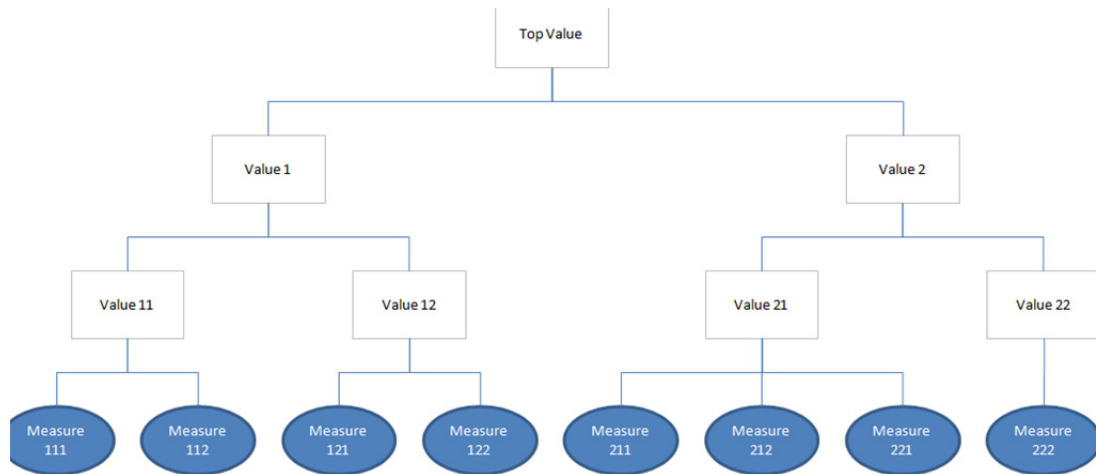
Figure 3 – Example Hierarchy

Top Value – This is the overall objective or problem. In this case it is determining the comparative importance of a foreign military engagement.

Value – These are the objectives which are determined to be the components or sub-components of the problem or overall objective. Often, there are multiple levels of objectives which is in turn what creates the hierarchy. The terms value and objective can be used interchangeably.

Measure – When a value is segmented to a level at which its components are self-reliant and in some way quantitatively defined they become measures and constitute the bottom of the hierarchy.

Alternative – Is a specific option which is being evaluated by the model. For example, in SAF/IA, the alternative could be an FMS Case, MPEP, Air show or a previously mentioned engagement event.

Process Steps

       Process steps (see Figure 4) 1-5 which detail the methodology and development of the hierarchy model will be addressed in this chapter. Steps 6-9 will be addressed in the next chapter, "Analysis and Results", while step 10 will be left, as appropriate, to the final chapter, "Conclusions and Recommendations".
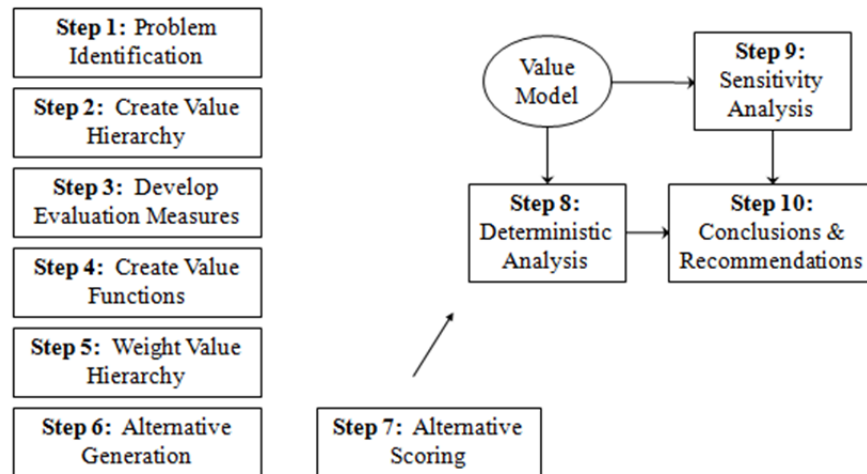

Figure 4 – 10 Step VFT Process (Chambal, 2003: 6)

Step 1 – Problem Identification

       This is determining what the overall objective of the decision maker is. It is represented by the top box in the hierarchy model and is the sum product of all underlying objectives. In this case, it is the importance of a foreign military engagement.

Step 2 – Create a Value Hierarchy

       This is done by segmenting the problem into objectives and is accomplished in conjunction with leadership and experts in the organization or field in which the model will be used. In this case, input was taken from leaders and experts within SAF/IA and OSD Policy. It is important to try to limit the size of the hierarchy while still completely

defining the problem. Tiers of sub-values will be created until the value can no longer be

subdivided and the value can be quantified.

TIER 1

Since, as previously mentioned, tiering products and historical data were deemed

insufficient and current information and future expectations were needed to inform the

decision, the problem was divided initial into two major objectives; Country and Event.

Country - represents the partner nation with which the U.S. military will engage. It

encapsulates significant data which is used in many of the previously mentioned tiering

products and therefore contains mostly historical data.

Event - represents the type of engagement that is being considered the expected effect of

that event. This objective encapsulates the current political-military landscape, the effect

the engagement is estimated to have on that landscape, and DoD strategic goals

associated with the specific partner.
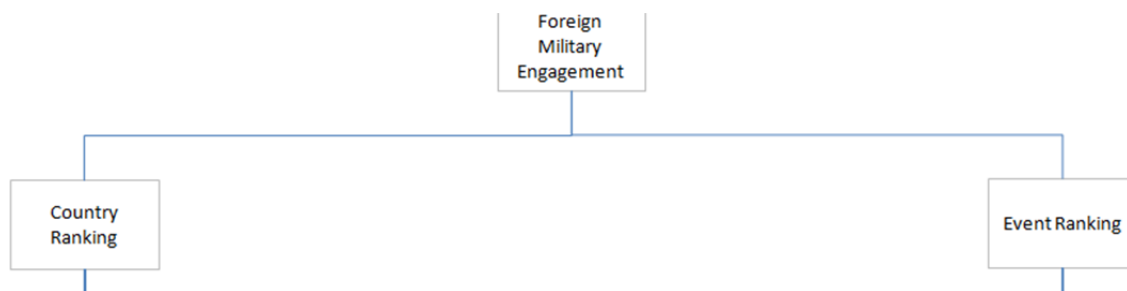
Figure 5 – Foreign Military Engagement Hierarchy Tier 1

TIER 2

The sub-values are developed to clearly segment the objectives. In this hierarchy a

second tier was needed to do so. Sub-values were given short titles for use in the model

due to limited space in graphical depictions and will be clearly defined below.
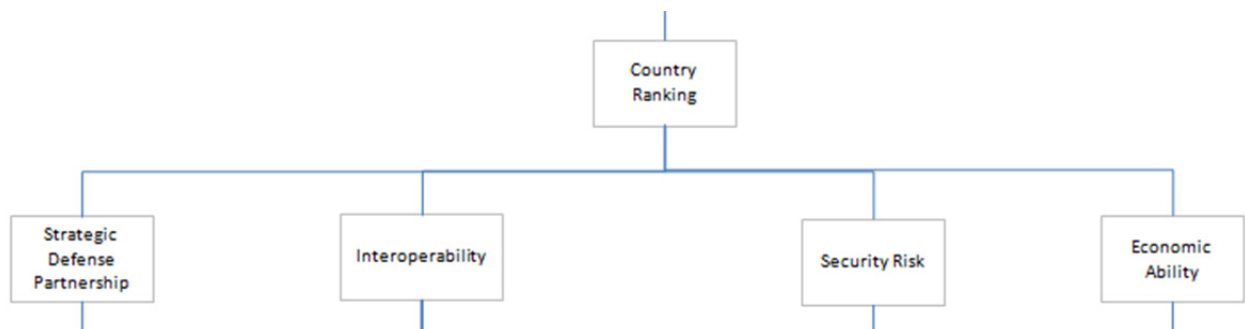
Tier 2 – Country Sub-Values

The Country objective was subdivided into four sub-objectives; Strategic Defense, Interoperability, Security Risk, and Economic Ability.

Strategic Defense – is the relative importance of a partner nation directly associated with the United States' ability to defend itself militarily. It involves the role the country is obligated to or expected to play in a time of conflict, which DoD has built contingency plans upon .

Interoperability – is the assessed capability and interoperability of a partner nation's fighting forces.

Security Risk – is the assessed risk assumed by U.S. forces by providing equipment or information to the partner country.

Economic Ability – is the assessed financial standing of the partner nation, which is often an asset or detriment to partnering with a given country.

Figure 6 – Foreign Military Engagement Hierarchy Tier 2 Country Sub-Objectives

Tier 2 – Event Sub-Objectives

The event objective was sub-divided into five sub-objectives; Support of U.S. Strategy, Regional Security, Political Implications, Cost of Inaction, and Defense Industry.

Support of U.S. Strategy – represents how and if the specific engagement supports the strategy of the combatant commanders or interagency leaders in the region or country.

Regional Security – represents an assessment of how regional partners will react to or be affected by a specific engagement.

Political Implications – represent the realities of the world the organization operates in constrained or committed by political leadership or legislation.

Cost of Inaction – represents the implications or ramifications should the engagement not occur.

Defense Industry – represents the effect of the engagement on the U.S. Government financially and /or U.S. defense industry.
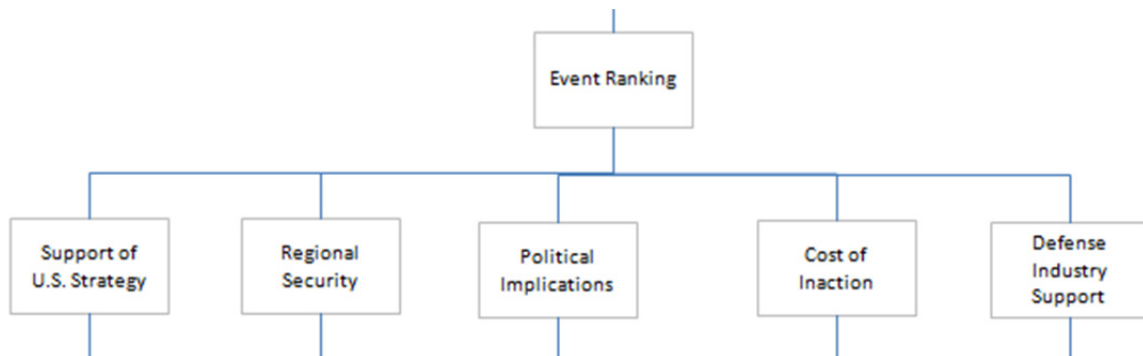
Figure 7 – Foreign Military Engagement Hierarchy Tier 2 Event Sub-Objectives

Step 3 – Evaluation Measures

Once sub-categorization is complete and it is determined that the final/bottom tier of the hierarchy is comprised of objectives which can be quantified, that final tier of objectives are referred to as Measures. Measures in particular are often determined using input from subject matter experts rather than leaders. In this case Measures were created with the assistance of SAF/IA division directors, country directors, and weapons experts

in conjunction with input provided from OSD Policy desk officers. In many cases Measures in this hierarchy are defined by DoD, USAF, or agency products or assessments. Each Measure will be described below under its respective Sub-Objective and again, have been given short titles to use in the limited graphical depiction of the hierarchy. In an attempt to avoid significant redundancy step 4 will be explained followed by the description of each Measure so that the valuation method for each Measure can be included with its description. Additionally, due to the number of Measures, the third Tier of the Hierarchy will be displayed in conjunction with their Weights in Step 4. (See Figures 9 and 10)

Step 4 – Value Functions

By definition, each Measure needs to be quantifiable and the process, by which the hierarchy model quantifies Measures, is through a Single Dimension Value Function (SDVF) for each Measure. Use of the SDVF for each Measure provides a common scale of 0 to 1.0 for all Measures while providing the flexibility to score individual measures by different means. Using SDVFs allows each Alternative to be consistently scored, then using the same local or global weights of the Measures to determine and compare each Alternative's overall scores. This function translates the relative importance of each particular Measure within each Alternative. Essentially, using the same hierarchy and SDVFs, ensures apples are being compared to apples.

According to Kirkwood, there are two different procedures often used in development of SDVFs. "One of these procedures results in a single dimension value function that is made up of segments of straight lines that are joined together into a *piecewise linear* function, while the other procedure uses a specific mathematical form

called the *exponential* for the single dimensional value function" (Kirkwood, 1997:61).

Chambal describes these more simply as Direct or Continuous respectively. Direct

SDVFs are described as categorical or binary and reflect a specified definition of a

Measure. Continuous SDVFs are represented by an exponential curve that runs

continuously through predetermined points. The Measure is then scored by determining

where the alternative falls on that line in respect only to that Measure. Additionally,

SDVFs are monotonically increasing or decreasing which adds flexibility to the model.

Essentially, this means that for some alternatives it may be preferred that the value is

closer to 0 while in others the preferred value is closer to 1. "That is, for monotonically

increasing preferences $v(Low) = 0$ and $v(High) = 1$, while monotonically decreasing

preferences $v(Low) = 1$ and $v(High) = 0$" (Kirkwood, 1997:66). In the Hierarchy Builder

created by Dr. Weir, Continuous SDVF are referred to as Continuous Decreasing or

Increasing, while Direct SDVFs, to include binary Measures, are referred to as

categorical since binary Measures are simply categorical Measures with only two

categories.

Examples of the different types of value functions can be found in Appendix A.

Based upon input received from SAF/IA leaders, only categorical and preferably binanry

SDVFs were used in developing this model. The ability to define scoring within each

Measure was more applicable to the Measures defined and leadership believed that this

approach maximized objectivity in the model. For example, one categorical SDVF

represents the Direct scoring of an Interagency Country Risk Assessment System

Measure. In this SDVF the scale ICRAS assigned grades of A through F are assigned

respective score on a scale of 0 to 1. Since the grades of A through F do not have equal

importance and the grade of C represents a passing grade, the monotonically increasing preference translation is as follows: A = 1, B = .9, C+ = .5, C = .3, C- = .2, below C- = 0. In a simpler binary example, the Treaty Measure, an Alternative will score 0 if there is no treaty in place and 1 if there is. This model allows this flexibility of differing SDVFs in each Measure, it is just important that every Alternative compared uses the same hierarchy and set of Measures/SDVFs.

<u>Measures and SDVFs by Sub-Objective</u>

Strategic Defense

<u>Treaty</u> – Does the country have a signed collective defense treaty? (i.e. members of NATO, ANZUS etc.) All applicable countries listed in Appendix B.

SDVF – binary – no = 0, yes=1

<u>Oplan</u> – Does the country play a role in a current Operations Plan (War Plan) for a relevant real world contingency?

SDVF – binary – no = 0, yes=1

<u>GEF</u> – How is the country categorized in the current Guidance of Employment of the Force? This is a classified DoD directive which provides policy guidance on security cooperation matters. Countries are categorized based upon their role as a partner in the world, theater, or in a contingency operation.

SDVF – categorical – Global Core Partner =1, Key Supporter = .75, Critical Regional Partner = .5, Prioritized End State Supporter = .25, none = 0

Interoperability

<u>U.S. MDE</u> – Does the country operate U.S. made Major Defense Equipment as defined by DoD 5105.38 (Security Assistance Management Manual)?

SDVF – binary – no = 0, yes=1

Training – Does the country participate with U.S. military forces in exercises and if so are those exercises held only in their country, region, or internationally? Are the exercises bilateral or multi-national?

SDVF – categorical – Multi-national = 1, Regional = .75, Bilateral (abroad) = .5, Bilateral (in-country) = .25, none = 0

Ops – Has the country participated in U.S. or coalition led kinetic operations?

SDVF – categorical – Within the last 5 years = 1, 10 years = .5, 20 years = .2, beyond 20 years = 0

MPEP – Military Personnel Exchange Program. Does the country actively exchange military officers with the USAF?

SDVF – binary – no = 0, yes=1

Security Risk

CISMOA – Does the U.S. have a signed Communications and Information Security Agreement with the country?

SDVF – binary – no = 0, yes=1

GSOMIA - Does the U.S. have a signed General Security of Information Agreement with the country?

SDVF – binary – no = 0, yes=1

NDP-1 – How does the National Disclosure Policy categorize the country for release of technology and equipment?

SDVF – categorical – Top Secret = 1, Secret = .75, Classified = .5, Unclassified = .25, Cat 2 = 0

Assessments – Are there any current, USG risk assessments suggesting the country is a significant security risk?

SDVF – binary – no = 1, yes = 0

Economic Ability

ICRAS - The Interagency Country Risk Assessment System (ICRAS) is a confidential interagency process through which the credit risk associated with U.S. credit assistance to foreign countries is assessed periodically. An interagency group chaired by OMB uses common standards for country risk assessment to rate countries on a scale of A to F- on the basis of economic and political variables. (USAID Automated Directives System - ADS - Chapter 249)

SDVF – categorical – A = 1, B = .9, C+ = .5, C = .3, C- = .2, below C- = 0. The categories are not all inclusive of possible ICRAS ratings; rather they are simplified to six categories, A, B, C+, C, C-, and D+ and below. The ratings are defined based upon their value. There is little difference on whether a country has an A or B ICRAS rating; both will receive financing options for purchases. The cutoff for providing foreign partner financing based upon the Arms Export Control Act is a C, so all letter grades below C, earn a score of 0.

Support of U.S. Strategy

TCP – Does the engagement being considered support the combatant commander's published Theater Campaign Plan?

SDVF – binary – no = 0, yes=1

CCP - Does the engagement being considered support the combatant commander's published Country Campaign Plan?

SDVF – binary – no = 0, yes=1

Interagency – Does the engagement being considered support a U.S. interagency effort in that country?

SDVF – binary – no = 0, yes=1

Regional Security

Multiple – Does the engagement involve multiple country partners?

SDVF – binary – no = 0, yes=1

Allies – Does the engagement support the goals of allies in the region?

SDVF – binary – no or conflicting amongst multiple allies = 0, yes=1

Stability – How will this engagement effect regional stability?

SDVF – categorical – Improves Stability = 1, No Effect = .5, Destabilizes = 0

Political Implications

Commitment – Have senior defense and/or government leaders committed to the engagement?

SDVF – binary – no = 0, yes=1

Legislation – Is there current legislation which compels or restricts the engagement?

SDVF – categorical – Legislation Compels = 1, Neither = .5, Restricts = 0

Cost of Inaction

Access – Is access in the nation or region gained or lost by participating in the engagement?

SDVF – categorical – Access Gained = 1, Lost = 1, Neither = 0

Influence – Does failure to participate in this engagement put USG influence in this country at risk?

SDVF – categorical – Influence put at Severe Risk = 1, Moderate Risk = .5, No Risk = 0

Security – Will failure to participate in this engagement degrade the security situation in the country or region?

SDVF – categorical – Severe Degradation = 1, Moderate Degradation = .5, No Effect = 0

Defense Industry

Joint - Does the engagement involve a joint procurement or collaborative development program?

SDVF – binary – yes = 1, no = 0

USG Cost – Does participation in this engagement lower costs or provide significant financial incentive for the USG?

SDVF – binary – yes = 1, no = 0

Industry – Does participation in this engagement support the U.S. defense industry?

SDVF – binary – yes = 1, no = 0

Step 5 – Establish Weights Across The Hierarchy

Based upon input from the leadership in the organization intending to use the model, each Objective and Measure in the hierarchy must be given a weight within its own hierarchy tier and branch which is considered the Local Weight.

Local Weight - like the Single Definition Value Function, local weights must fall within a range of 0 and 1. Unlike the SDVF, all local weights within each Objective branch of each Tier must combine for a sum of 1. Essentially each Sub-Objective represents a defined percentage of importance to the Objective above as is depicted below.
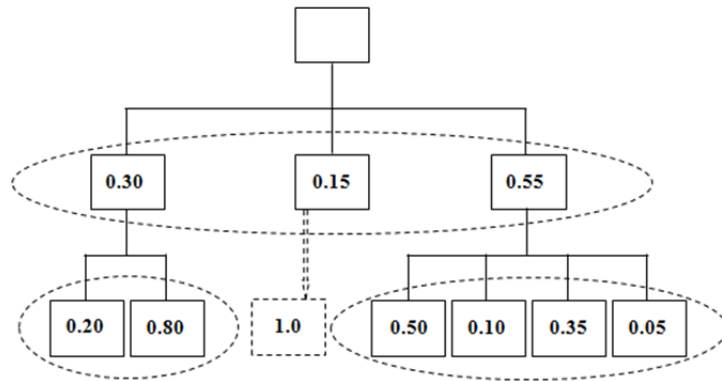
**Figure 8 – Local Weights Example (Chambal, 2003:37)**

There are two predominate means in determining the weights of each Objective and Measure; Swing and Direct weighting. Either approach can be used and in fact, both approaches can be used with the same model. The decision on which approach to use mostly depends on which is easier for the decision maker or subject matter expert providing weighting input.

Swing Weighting – determines weights by comparing the Objectives or Measures to each other. Kirkwood describes this process well (Kirkwood, 1997:70).

1 Consider the increments in the value that would occur by increasing (or "swinging") each of the evaluation measures from the least preferred end of its range to the most preferred end, and place the increments in order of successively increasing increments.

2 Qualitatively scale each of these value increments as a multiple of the smallest value increment.

3 Set up the smallest value increment so that the total of all the increments is 1.

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4   Use the results of step 3 to determine the weights for all evaluation measures.

Direct Weighting – asks the decision maker to directly assign values to Objectives and

Measures between 0 and 1, ensuring that the sum within a Local Weight is 1. If it is

easier the decision maker can think of this on a scale of 0-10 or 0-100, whatever is easiest

for that individual to conceptualize.
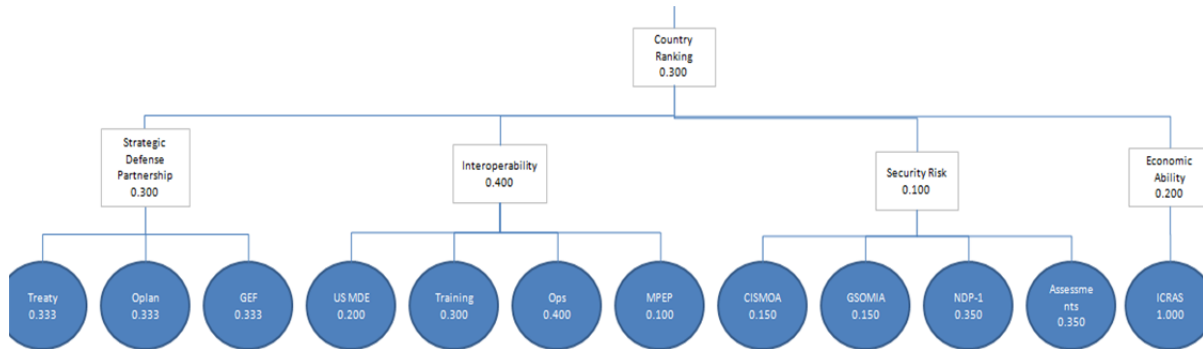

Figure 9 – Local Weights Country Objective Branch
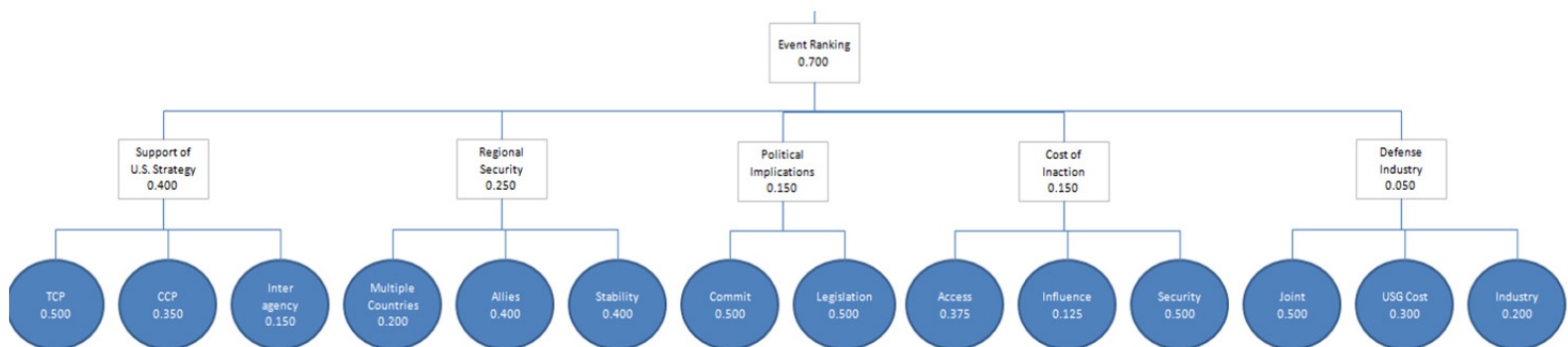
Figure 10 – Local Weights Event Objective Branch

Once the Local Weights are established and entered into the Excel-based

hierarchy builder program, Global Weights are calculated.

Global Weight – is essentially each individual Objective's or Measure's overall value in

relation to the other Objectives or Measures in the same Tier. Rather than the sum of

Local Weights equaling 1 within an Objective branch, all Global Weights across the same

Tier will equal 1. (See Figure 11)
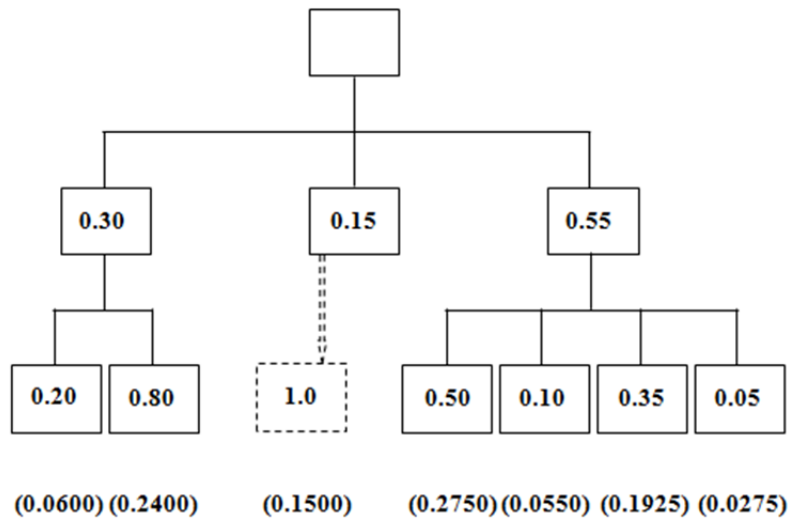
Figure 11 – Global Weights Example (Chambal, 2003: 37)

(Global Weight in parentheses)

In developing this model, input for weighting Objectives and Sub-Objectives

were taken from the following senior leaders; the Deputy Assistant Secretary of Defense

for European and NATO Policy, James Townsend Jr., the Deputy Under Secretary of the

Air Force for International Affairs, Heidi Grant, and the Assistant Deputy Under

Secretary of the Air Force for International Affairs, Major General Richard Johnston.

Input for the weighting of Measures came from SAF/IA regional and weapons subject

matter experts and Colonel Richard Pearcy, EUCOM Division Director, as well as Niall

Brannigan from OSD Policy.
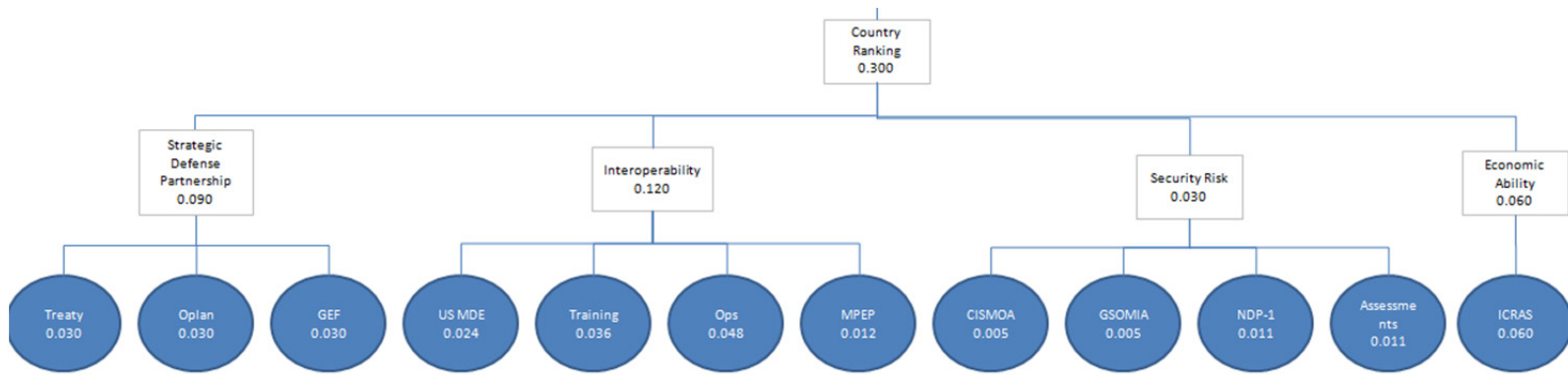
Figure 12 – Global Weights Country Objective Branch

(Global Weights have replaced Local Weights in this depiction)
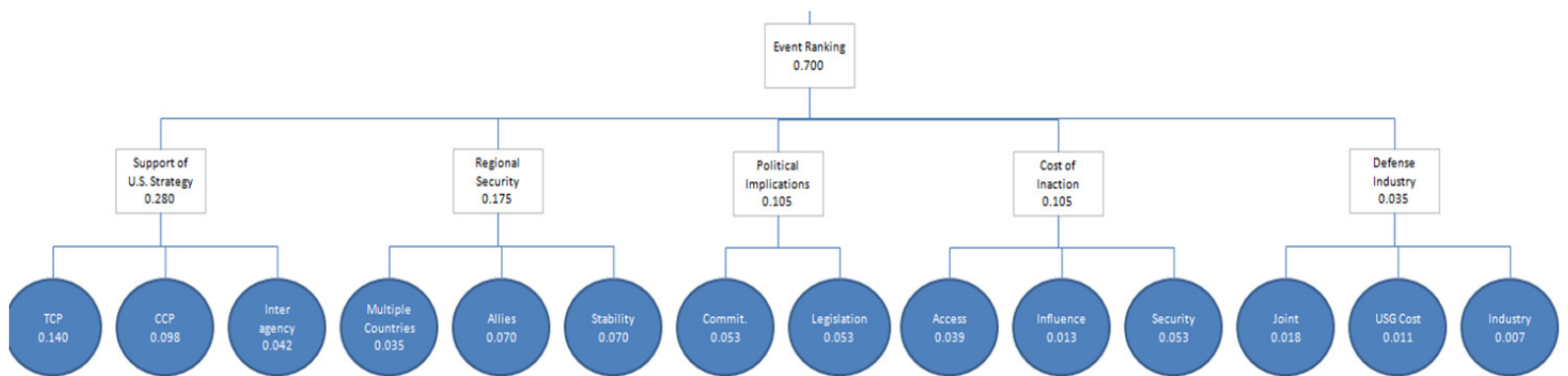
Figure 13 – Global Weights Event Objective Branch

(Global Weights have replaced Local Weights in this depiction)

Summary

This chapter has described the decision analysis process of a MODA hierarchy using VFT. Specifically, it has covered the first five steps of the process starting with identifying the problem, then creating a value hierarchy, evaluating measures, developing value functions, and establishing weights across the hierarchy. In the next chapter, alternatives will be generated and then scored using Dr. Weir's

hierarchy builder. The results of this scoring will be analyzed to determine if this process

does in fact yield a useful product for informing the prioritization of foreign military

engagements.

IV. Analysis and Results

Chapter Overview

A Multiobjective Decision Analysis approach using Value Focused Thinking has generated a model using Dr. Weir's hierarchy program and the first five steps of Dr. Chambal's 10 Step VFT Process. In order to test the model and determine if it is useful, alternatives must be chosen and compared using the model. Since using real world information would make this product classified, alternatives were generated, representing fictitious countries and scenarios to test the model. Since this model is being developed for potential use in SAF/IA, the fictitious engagements are Foreign Military Sales as they are of great importance to the organization, are diverse in nature, regularly prioritized, and receive significant attention outside of the organization. However, it is important to note that the model could be used the same way for analyzing any other types of engagements as well.

Step 6 -Alternative Generation

Three alternatives have been developed using the model created in the previous chapter. Some basic information on the engagement, in this case Foreign Military Sale, has been produced for the purpose of this exercise. In reality, the only information needed on these alternatives to effectively run the model are the answers to all of the questions asked in the Measures Tier of the hierarchy which is provided in Table 1. The background information below is provided simply to create a narrative and add a flavor for the type of engagement the alternative represents. This background information is consistent with what is provided in the hierarchy, may in some ways be extraneous, but is useful in describing the country and the engagement.

Country A - C-17 Case - Country A is a long standing ally of the United States. It is part of a collective defense agreement with the U.S. and has fought side by side with U.S. forces in recent conflicts. It is considered a strategic partner in its region and throughout the world due to its willingness to train and operate in an expeditionary fashion. Recent operations have emphasized to the country their deficiency in getting their troops and equipment to the fight, which has led them to decide to purchase four new C-17 aircraft. The capability gained will allow Country A to get to AORs in which we have and will operate jointly without direct U.S. assistance. The case will include the aircraft, necessary training for pilots and maintainers in the U.S., and contract logistics support for three years after the aircraft are delivered. The case is estimated to cost $2.3 billion, which will be paid by the country over a period of five years since it is not considered a credit risk by the USG. The first aircraft would be delivered in 2014, just in time to have their pilots and maintainers ready to receive the first aircraft.

Country B - F-16 Case –Country B is a small country and a relatively new U.S. ally, only one to two generations removed from its time as a communist dictatorship. The country's Air Force has a long and proud history, but its aircraft inventory has been hollowed out by the failure to invest in new aircraft. While a member of a collective defense agreement, it still operates legacy fighter aircraft from the former Soviet Union despite the fact that many are far beyond their usable life. The country has been hit hard by the recent global economic crisis and defense spending in the country has not been to a level to allow the force to recapitalize. The country has been a dedicated partner, participating whenever asked in out of area operations and offers access above and beyond what is requested, but limits its training with U.S. forces to exercises that it hosts

due to the expense of traveling abroad for training. Completing this sale will have a significant positive effect on the relationship the U.S. has with Country B, raise their level of military capability, and will make them a more valued regional partner. This FMS case will provide 16 x F-16 aircraft, language, maintenance and pilot training for the necessary country forces, significant upgrades to base infrastructure, and contract logistics support for a period of three years after aircraft delivery at a cost of $1.8 billion. Additionally, this case is being discussed as a possible regional approach to security with neighboring countries who are interested in purchasing the same aircraft and investing in cost-saving collaborative efforts. However, due to the questionable financial standing of the country and restrictions from current legislation, a payment plan is not available for this country, so they must find a way to finance this program which is, by itself, twice their annual defense budget. Primarily for this reason, the COCOM is not a strong supporter of this engagement. Despite this fact, several DoD and U.S. political leaders have committed to assist Country B in making this acquisition. This case also has significant relevance to the U.S. defense industry. The F-16 production line is approaching closure and will only remain open while orders exist. If this deal, or a few others like it, are not consummated, the U.S. will lose its ability to export a lower cost (compared to the fifth generation fighter, F-35), capable, and interoperable fighter aircraft to its allies. Additionally, if this case fails to go through, Country B will likely purchase a less capable, less U.S. interoperable fighter aircraft from another country which will replace the U.S. in terms of access and influence in that country.

Country C – KC-135 Case – Country C is an important partner and one of the greatest U.S. supporters in its region, but does not have a signed collective defense agreement

with the United States. While Country C does operate U.S. aircraft and trains with U.S. forces when given the opportunity in the region, it has not fought alongside U.S. forces in recent conflicts, but conveys interest in operating outside of its region. One of the major reasons it does not participate in exercises in the U.S. or operate off of its continent is its lack of tanker aircraft providing the ability to power project using its fighter assets. Country B is requesting 2 x KC-135s which would be taken from the bone yard and regenerated with newer and more capable equipment and systems by a U.S. defense contractor. The case will include the aircraft, upgrades, training for pilots, and maintainers, and contract logistics support for three years following delivery. Total case value is $350 million. Country C has a solid financial rating, so a payment plan will be provided. There have been no specific promises by leaders and no legislation compels or opposes this sale. The case is of importance to the single defense contractor, but does not affect the industry as a whole or have any impact on the USG financially.

Step 7 – Alternative Scoring

Once the alternatives were created and defined, they were entered into the hierarchy model by selecting the appropriate answer or category for each Measure using a drop down menu in the Excel-based hierarchy program. Upon completion, the populated spreadsheet in the program displayed all of the information shown in Table 1, just in a slightly different format. After all Measures are entered, those entries generate a score for each Measure based upon the selection made in the SDVF.

Measure	Country A C-17	Country B F-16	Country C KC-135
	Alternative Name		
Treaty	Does have	Does have	Does not have
Oplan	yes	yes	yes
US MDE	yes	no	yes
Training	Multi-National	Bilateral In-Country	Bilateral In-Country
Ops	yes	yes	no
MPEP	yes	yes	yes
CISMOA	yes	yes	yes
GSOMIA	yes	yes	yes
NDP-1	Top Secret	Secret	Secret
Assessments	no	no	no
ICRAS	A	C-	B
TCP	yes	no	yes
CCP	yes	no	yes
Interagency	no	no	yes
GEF	Global Core Partner	Critical Regional Partner	Critical Regional Partner
Multiple Country Participants	no	yes	no
Allies	no	yes	no
Stability	no effect	Stabilizes	Destabilizes
Commitments	no	yes	no
Legislation	neither	restricts	neither
Access	Gained	Lost	no effect
Influence	no effect	moderate risk	no effect
Security	No Effect	No Effect	No Effect
Joint	no	no	no
USG Cost	no	yes	no
Industry	yes	yes	yes

Table 1 – Measures of Compared Alternatives

Measure	Alternative Name		
	Country A C-17	Country B F-16	Country C KC-135
Treaty	1	1	0
Oplan	1	1	1
US MDE	1	0	1
Training	1	0.25	0.25
Ops	1	1	0
MPEP	1	1	1
CISMOA	1	1	1
GSOMIA	1	1	1
NDP-1	1	0.75	0.75
Assessments	1	1	1
ICRAS	1	0.2	0.9
TCP	1	0	1
CCP	1	0	1
Interagency	0	0	1
GEF	1	0.5	0.5
Multiple Country Participants	0	1	0
Allies	0	1	0
Stability	0.5	1	0
Commitments	0	1	0
Legislation	0.5	0	0.5
Access	1	1	0
Influence	0	0.5	0
Security	0	0	0
Joint	0	0	0
USG Cost	0	1	0
Industry	1	1	1

Table 2 – Measures' Scores of Compared Alternatives

Step 8 – Alternative Analysis

Once the program has recorded a numerical score for each Measure of each Alternative based upon the SDVF of the model, it then multiplies that score by that Measure's Global Weight. Then, the program adds those 26 products to create a total score for that Alternative. Additionally, it depicts this score in the form of a bar chart segmented by each of the Alternative's weighted Measures. Mathematically, it uses the following equation:

$$Score_i = \sum_{j=1}^{n} m_{ij} w_j$$

- i represents the Alternative, in this case, Countries A, B and C
- j represents the Measure, in this case, there are 26 of them
- m represents the score given to Measure j in Alternative i
- w represents the Global Weight of Measure j

When the total scores of the Alternatives analyzed are created they are displayed as a ranking from highest to lowest. The bar graphs segment each Alternative by the individual scores of each Measure, each of which is represented by a different color. A color key is displayed below the bar graph for easy reference. While the weighted scores of each Measure are not displayed, when using the model in Excel, the cursor can be rolled over each individual segment to display the title of its Measure, the Global Weight of that Measure, and the segment's weighted score. This depiction and data provided

allows a decision maker or any user to easily and clearly distinguish the differences between alternatives.
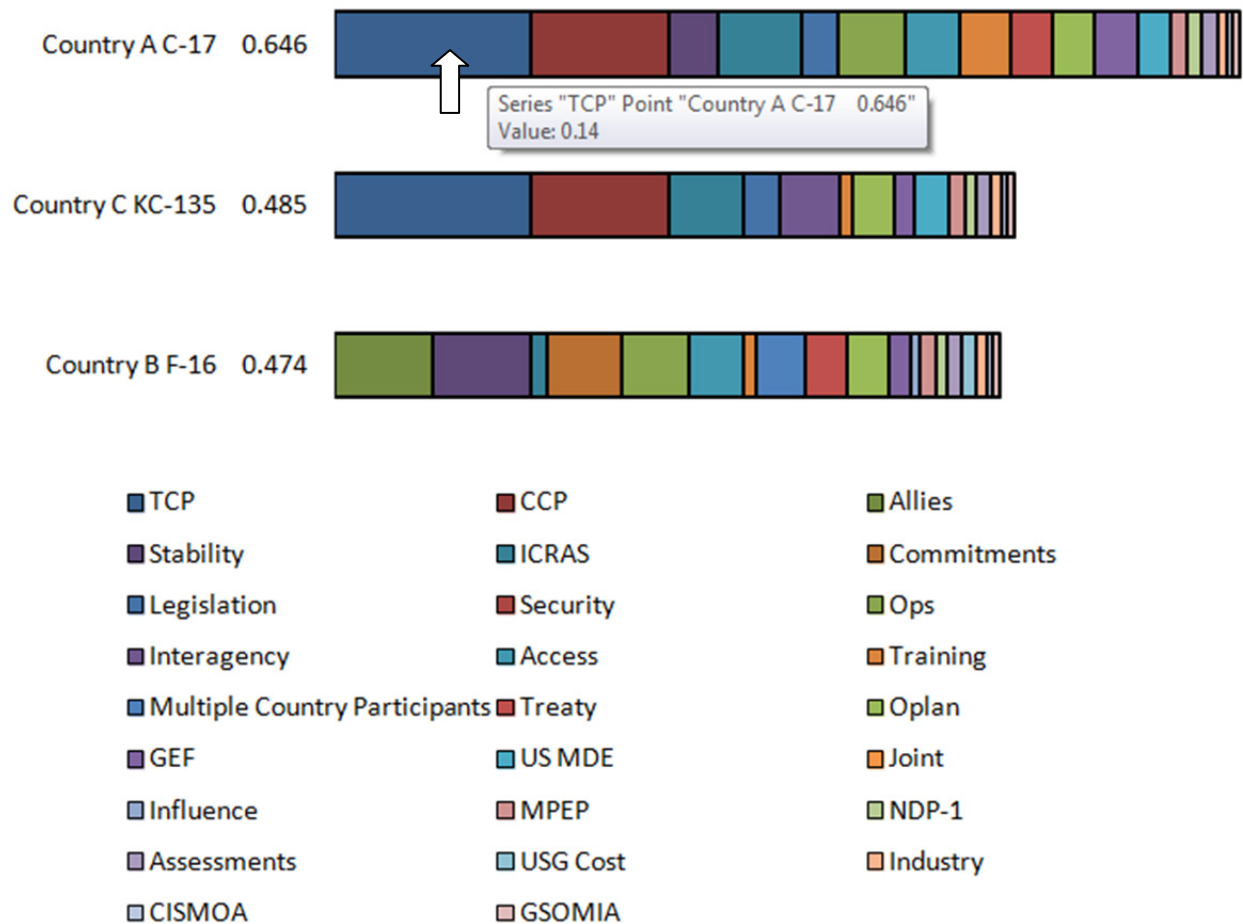
Figure 14 – Alternative Total Score

The model recommends a priority ranking of Country A, Country C, then Country B based on the total scores. None of the Alternatives even come close to a perfect score; in fact, Country A is the only Alternative to just break the 50% mark with a total score of 0.646. Country C beats out Country B for the second spot, but only barely, by just 0.011.

The Total Score product also displays the hierarchy's Measures in order of Global Weight from left to right. This is depicted in the bar chart by the segments getting smaller as it moves right and is also represented in the color key from top left to bottom

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right. The segmented bar chart allows users to clearly differentiate which Measures are supporting Measures for each alternative. While the Global Weight of each segment is not constantly portrayed here, in the program any segment can be scrolled over to have it display the Global Weight and Measure's score. Based up the heavy weight given to the Event Value of 0.7 compared to only 0.3 given to the Country Value, it is not surprising that 4 of the top 5 and 8 of the top 10 Globally Weighted Measures were from the Event branch of the hierarchy. The Country branch Measures therefore dominated the middle of the Measures rankings, but the bottom 10 Globally weighted Measures were fairly evenly dispersed between the two Tier 1 branches.

Step 9 – Sensitivity Analysis

Once a model has been developed and the Alternatives have been evaluated by the model, a sensitivity analysis can be run to determine the impact on the ranking of Alternatives based on the changes in model assumptions, namely weight (Kirkwood, 1997:82). Looking at these sensitivity analysis charts show how the priority rankings may or may not change due to a change in the total score if the weight on a particular Value or Measure is adjusted. The sensitivity analysis can be produced in two ways.

Global Proportional Sensitivity Analysis - "This type of sensitivity analysis allows the user to see how the values of the alternatives would change if the global weight of a single measure varies from 0 to 1. All weights for the remaining measures not being evaluated for sensitivity will be adjusted proportionately based on their original weights" (Weir).

Local Proportional Sensitivity Analysis – "This type of sensitivity analysis allows the user to see how the values of the alternatives would change if the local weight of a single

measure or value varies from 0 to 1. All weights for the remaining measures or values in the same branch not being evaluated for sensitivity will be adjusted proportionately based on their original weights" (Weir).

The analyses performed on this model and discussed below are all global proportional sensitivity analyses. Local analyses will be discussed in the next chapter.
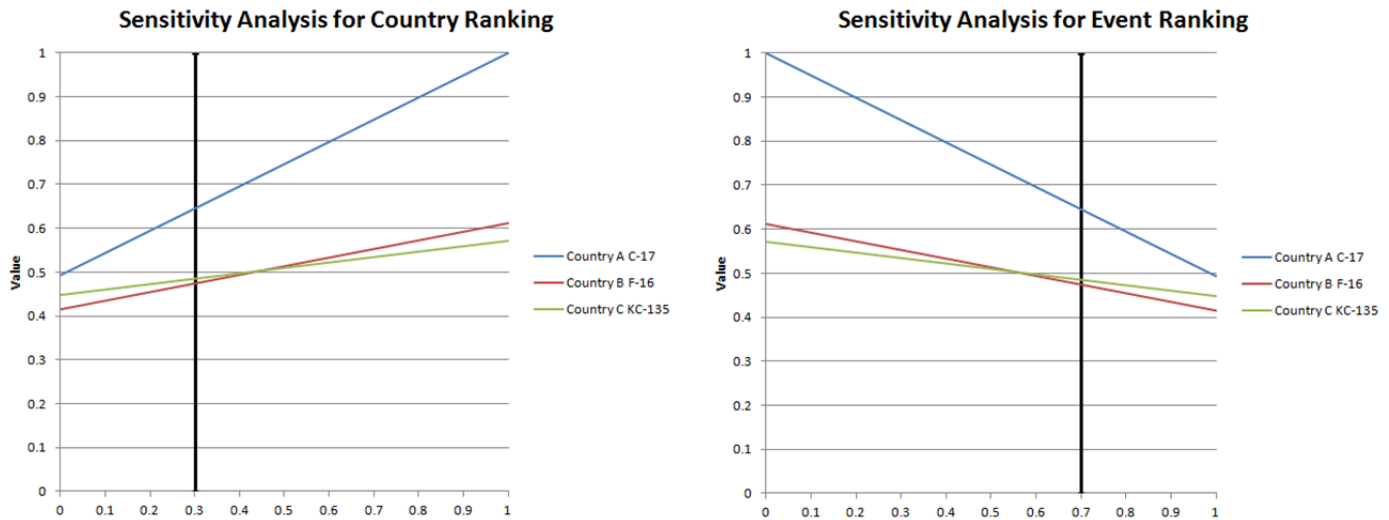
Figure 15 – Country and Event Sensitivity Analysis

The first sensitivity analyses portrayed are those done on the Tier 1 Values displayed in Figure 15. This analysis shows that if the weights were shifted in this tier and Country Ranking weight was dropped from 0.3 to any lower weight, the results would remain unchanged. However, if the Country Ranking weight was raised to just above 4.3, the prioritization of Alternatives would change and Country B would actually replace Country C with the second highest total score. Conversely, if the Event Ranking weight shifted up from 0.7, there would be no change, while shifting it down to below 5.7 would send County B into second place and County C into third. Alternatives would change again and Country C would fall below Country B with the lowest total score. The

analyses of the other 6 of 9 Tier 2 Values showed no change in priority rankings if their Global Weights were changed.
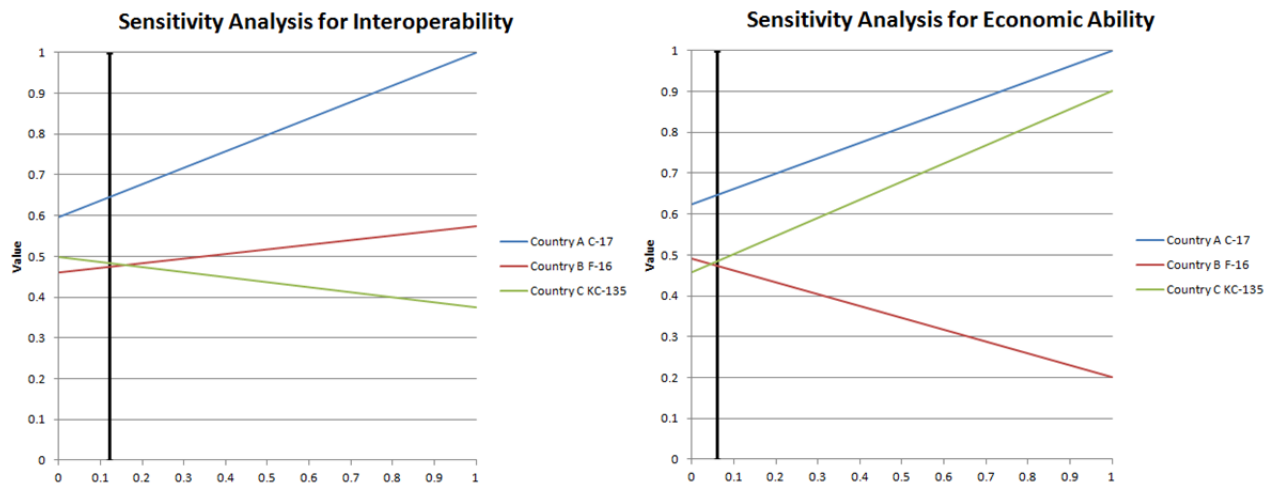
Figure 16 - Tier 2 Country Branch Sensitivity Analysis
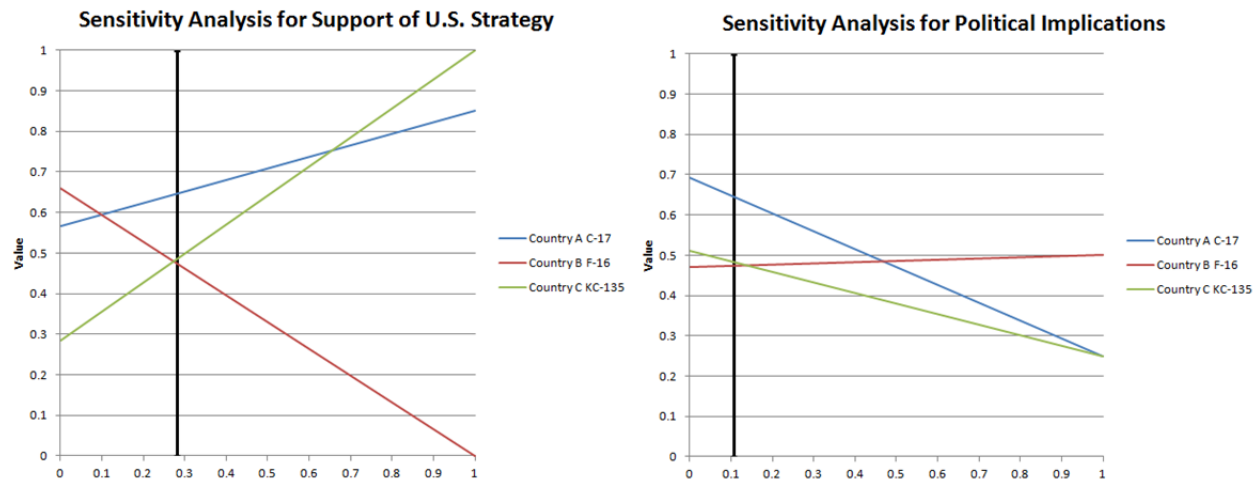
Figure 17 - Tier 2 Event Branch Sensitivity Analysis

In Tier 2, sensitivity analyses of Values (See Figures 16 and 17) showed significant potential for total score changes in 8 of 9 Sub-Values. The potential is present in both the Country and Event branches, but is more prevalent, as expected, in the Event branch since it is more heavily weighted, 0.7 to 0.3. Of the 4 Country branch

Values, 3 of them (Strategic Defense, Interoperability, and Economic Ability) showed that small changes in the Global Weight breakdown in this tier would lead to Country B replacing Country C in second place of total scoring. Since those scores are so close, only 0.11 apart, it is not surprising that small weight changes would change the total score ranking. In the Event branch Value sensitivity analyses, Country B showed the possibility of not only surpassing Country C, but the possibility of passing Country A and taking the top spot in total score ranking. Surprisingly, this was actually the case in all 5 Values. In all cases, a small increase or decrease (Value dependent) in the Value's Global Weight could cause Countries B and C to swap spots in the ranking, but in order for Country B to displace Country A in the top spot a very significant change in weights would be needed (See Figure 17). The "Support for U.S. Strategy" Value presented not only the smallest weight change required to move Country B from the third to first spot, a Global Weight decrease of only 0.15, and was the only value which reached that result by decreasing its Global Weight rather than by increasing it.
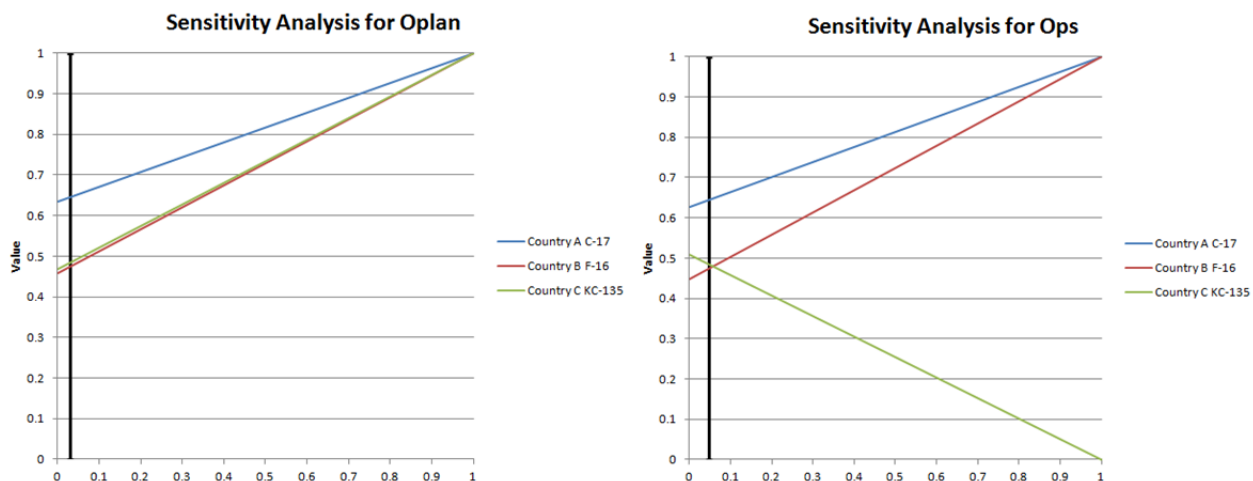
Figure 18 - Tier 3 Measures Country Branch Sensitivity Analysis
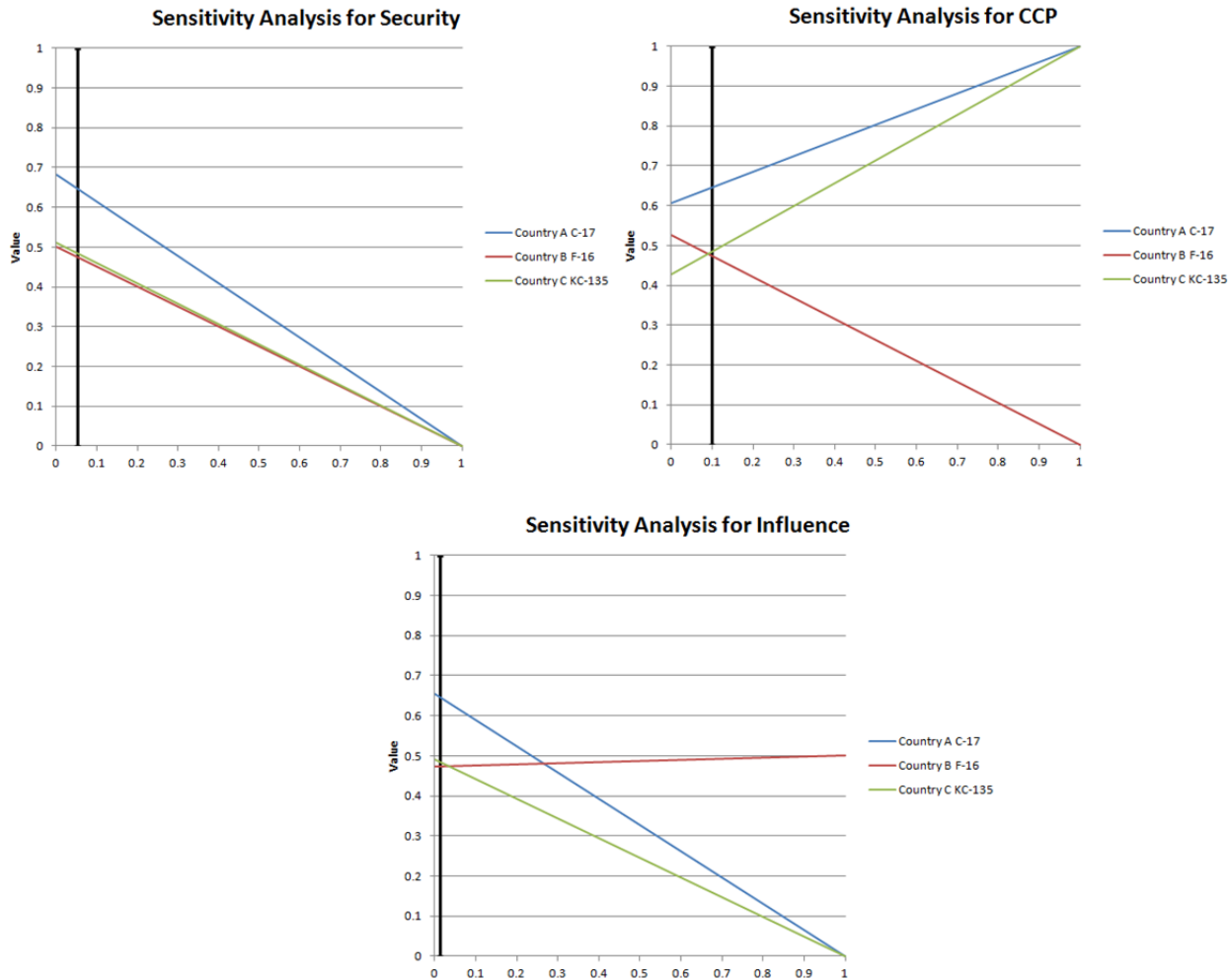
Figure 19 - Tier 3 Measures Event Branch Sensitivity Analysis

Analysis of the Measures tier showed examples of potential score changes in

Global Weights affecting the rank order of Alternatives' total scores in a similar manner

as the Sub-Value in the same branch. In the Country Branch 3 Measures (Treaty, MDE,

and Ops) showed the potential for Country B to overtake Country C if relatively small

changes were to be made to weighting of these Measures (See Figure 18, Ops). All the

remaining Measures in the branch proved to have no other affect on priority rankings.

The Measures in the Event branch were a bit more diverse in their sensitivity in that 3

different possibilities existed; no change, Country B surpassed C for second place, and

Country C surpassed A for first place. The Measures which did not influence rank change at all with respect to total score were Industry, Joint, and Security. The measures which showed that Country B could only surpass Country B were Legislative, Access, TCP, and CCP. The Measures which showed that Country B could surpass both C and A were actually the largest in number; Interoperability, Multiple, Allies, Stability, Commitment, and USG Cost (See Figure 19).

Summary

This chapter has created three realistic Alternatives to be scored using the Multiobjective Decision Analysis model. Dr. Weir's "Hierarchy Builder" Excel-based program has successfully taken the hierarchy built using Value Focused Thinking techniques and generated a numerically and graphically represented product to prioritize the Alternatives created.

V. Conclusions and Recommendations

Chapter Overview

This chapter will provide conclusions to the research relating both to the methodology and the model created. It will also provide recommendations on if and how this research can be used in SAF/IA and in other organizations throughout DoD to prioritize foreign military engagements.

Conclusions of Research

The purpose of this paper was to determine if a tool or process could be created to more objectively inform DoD leaders as they seek to prioritize foreign military engagements in a budget and resource constrained environment. The Foreign Military Engagement Model does just that. The results from hierarchy analysis make a couple important points.

First, and most importantly, that a model which includes information pertaining to current situations and future goals/expectations creates a different recommendation than one which only uses historical data like the many tiering products found around DoD.
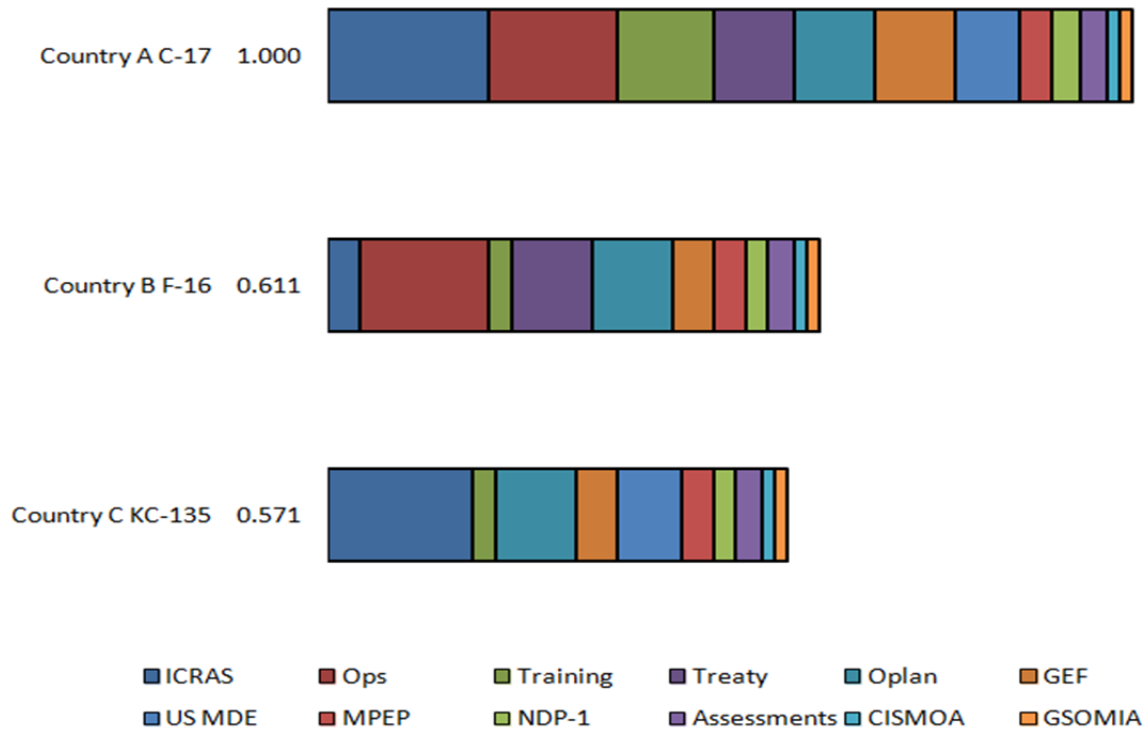
Figure 20 – Country Branch Only Alternative Score

By running the Alternatives through the model with only the Country Ranking branch Values and Measures as is done in Figure 19 (or by looking at the Tier 2 sensitivity analysis in Figures 15), the tool generates a different total score and Alternative rank order. This uses only similar criteria to that used in the country tiering products discussed in Chapter 2 and therefore produces the same recommendation those products would if used, one based solely on historical data and ratings. The ability of the Foreign Military Engagement model to account for current and even expected information associated with the Event and appropriately weighted by the decision maker, makes it a far more useful tool in prioritizing future foreign military engagements.

Next, it is vital to note that the Foreign Military Engagement model does not take monetary cost into consideration. This is especially important given the Alternatives chosen to prioritize, Foreign Military Sales. The reason is simple: assigning a price tag to an engagement, or anything for that matter, is one way of setting its value. What this model does is set the Alternatives values (or total scores) based upon a set of objective criteria. The resulting prioritized list, as was displayed in this example, can be very different than a list of engagements in descending dollar values.

Alternative	Case Value in USD
Country A	$2,300,000,000
Country B	$1,800,000,000
Country C	$350,000,000

Table 3 – Alternative's Case Values

Not only would it be helpful to remove case values when comparing FMS alternatives, but more importantly when comparing differing types of engagements since the costs of each can be so different.

Research Objectives/Questions/Hypotheses

This research project attempted to create a tool which will provide decision makers with an objective recommendation when comparing similar foreign engagements in order to prioritize security cooperation resources. The model built using Dr. Weir's Hierarchy Builder and the concepts and methodologies of Multiobjective Decision Analysis and Value Focused Thinking have created a tool which meets the criteria defined at the onset.

The model does:

1 – generate a quantitative outcome

2 – is applicable and useable with all variety of security cooperation engagements

3 – directly applies criteria deemed appropriate or relevant by the decision maker and factors in the decision maker's opinion of relative importance

4 –calculates a total score for each Alternative analyzed and generates a visual depiction of the results in the form of a segmented, color coded bar graph

The Value Focused Thinking approach to building the Foreign Military Engagement hierarchy from the top-down, forced the establishment of a comprehensive set of Values and Measures to fully explore the spectrum of criteria that is necessary to make a fully informed prioritization decision. The use of categorical SDVFs, by design, removed a significant amount of subjectivity from the model, especially where the SDVFs were binary as requested by SAF/IA. There is still, however, a certain level of subjectivity that remains in the model.   Some of the Measures SDVFs are based upon an assessment by an individual to make the appropriate categorical selection within an SDVF. Other SDVFs are based on a ranking or assessment from an external agency, which are likely subject to their own biases or perceptions. It may not be possible to remove all subjectivity from a decision most would consider almost entirely subjective by nature, but taking this very qualitative problem and making it as quantitative as possible is indeed useful.

Significance of Research

This research shows that using a process and methodology to make a decision, or in this case many decisions, in order to best prioritize how an organization focuses its efforts and expends its resources is extremely useful. Not only are the total score and bar graph products helpful to the senior leader by informing the decision, they are great resources in communicating the decisions made. The ability to justify decisions made in a quantitative manner that is easy for any audience to digest is invaluable. Additionally, there is tremendous benefit gained throughout the organization by the communication within the organization required to develop the model. The criteria provided jointly by leaders and subject matter experts which become Values and Measures, then combines with the Weights associated to them by senior leadership, provides tremendous information up and down the organization's chain of command about what is important and why.

Recommendations for Action

This Foreign Military Engagement model is ready to be tested using current Alternatives to analyze the results. Due to the sensitive nature of some of the "real world" inputs to the hierarchy builder the model should be implemented at SAF/IA on a SIPR system with real, classified data. I would recommend the model first be used on the FMS Case prioritization list, and then expanded to be used it in other areas to inform the decisions which prioritize limited resources. It can inform decisions such as which partners will get priority when requesting Excess Defense Articles, prioritizing Military Personnel Exchanges, foreign military exercise participation, and attendance at foreign

air shows. Most importantly, this model should be used to communicate and powerfully justify the prioritization decisions made to those outside of SAF/IA. The total scores and bar graphs are easy to follow even for those unfamiliar with the methodology or process and may be very useful when communicating SAF priorities to the DoD level at OSD Policy or the Defense Security Cooperation Agency (DSCA) or even to interagency organizations.

Recommendations for Future Research

Once the model is implemented with "real world" data, it is likely that the hierarchy may need to be amended to adjust the weighting scheme. After the results are presented, there will be a need to work with leaders in SAF/IA to re-scope the model and weighting scheme to meet their needs. Leaders should be brought together to come to a consensus on weights by comparing global weights with each other to see if the relative importance has been encapsulated appropriately. It will be important to keep in mind that depending on what type of engagement is being prioritized, weights, especially in the first tier, may need to be adjusted. Additionally, it may be that additional Values or Measures are needed to be added or dropped due the type of engagement. If possible, I recommend leaning down the number of Values and Measures if it can be done without comprising the integrity of the model. As it is, the model is quite comprehensive, but using it may become cumbersome as larger numbers of Alternatives are used.

As mentioned earlier, costs of the engagement were not considered as part of the hierarchy intentionally. Especially when comparing FMS efforts, as the costs are primarily born by the foreign partner. This does not however, suggest that cost is not an

important factor in any decision on prioritization of resources. In fact, USAF support of FMS cases often come at some cost be it in man hours or travel costs incurred to meet with foreign partners, while the actual case value is likely more important to the partner.

I suggest that cost be considered along with the results from a model like this one. Perhaps a cost vs. benefit graph or in this case a cost vs. total score graph would be helpful to compare the price tag associated with supporting the highest priority engagements. This would offer senior leaders the opportunity to be efficient and well as effective. Additionally, doing so may allow senior leaders to visualize which priorities they are taking, what the costs are, and determine if the pursuing the highest priority makes sense. In some cases it may be obvious that bypassing a higher priority to accommodate two or more Alternatives with lower total scores but also lower costs, maybe be a more efficient way of doing business.

Finally, it would be interesting to see how well the model stands up across dissimilar engagements; for example comparing an FMS case with a personnel exchange and an air show. I suspect that the tool may still be useful, but not to the level it is when comparing like events.

Summary

Multiobjective Decision Analysis and Value Focused Thinking are useful methodologies that can and should be used consistently through life. Not only does the process help define the real question or problem better, but using a quantitative approach helps to reduce subjectivity and more clearly communicate or justify decisions. As budgets shrink and resources become scarce throughout DoD and the Air Force, the

ability to effectively prioritize will only become more valuable. The Foreign Military

Engagement model created will help senior leaders who choose to use it, do just that.

Appendix A
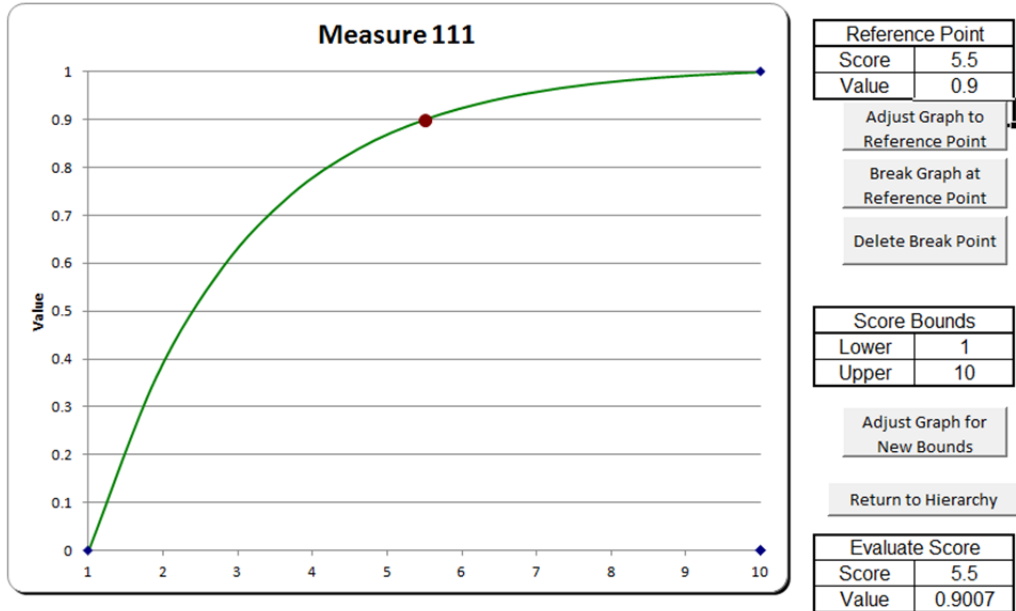
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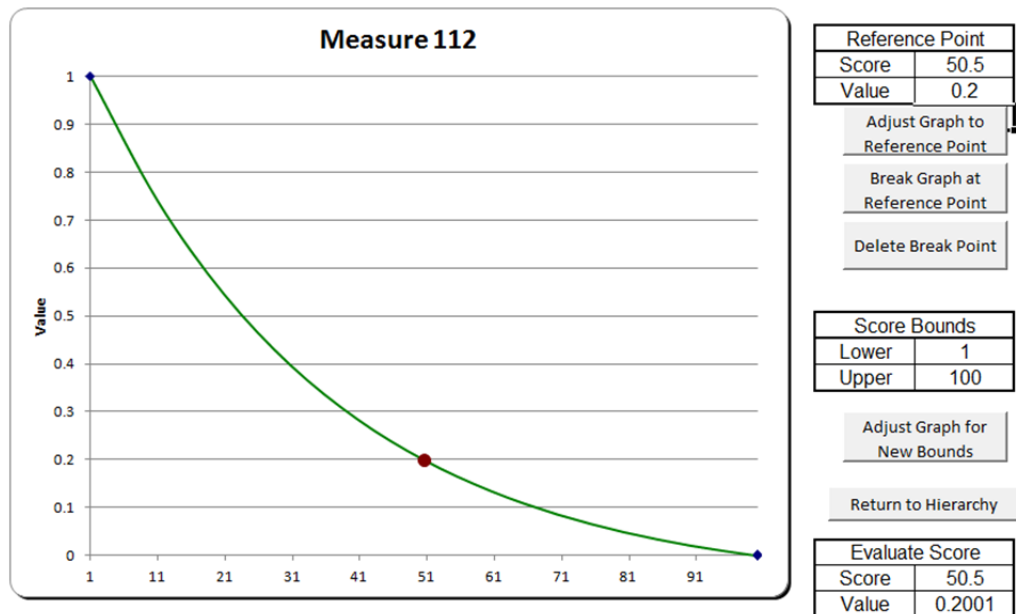
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56
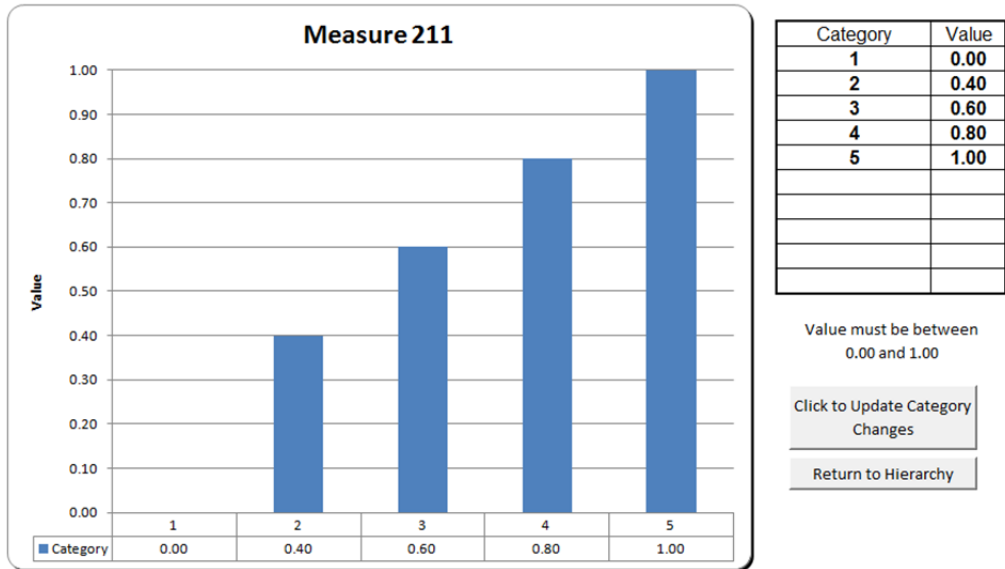
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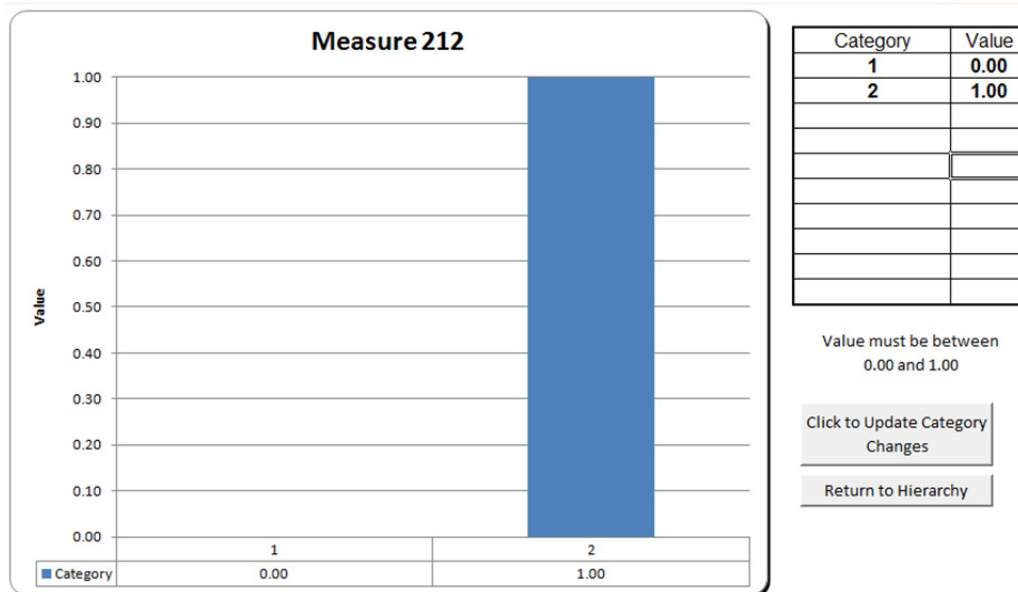
Binary Single Dimension Value Function

U.S. Collective Defense Arrangements

Set forth below is a list of U.S. collective defense arrangements and the parties thereto:

NORTH ATLANTIC TREATY

A treaty signed April 4, 1949, by which the Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all; and each of them will assist the attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force.

PARTIES: United States, Albania, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Turkey, United Kingdom

AGREEMENT BETWEEN THE UNITED STATES AND AUSTRALIA AND NEW ZEALAND

A Treaty signed September 1, 1951, whereby each of the parties recognizes that an armed attack in the Pacific Area on any of the Parties would be dangerous to its own peace and safety and declares that it would act to meet the common danger in accordance with its constitutional processes.

PARTIES: United States , Australia, New Zealand

PHILIPPINE TREATY (Bilateral)

A treaty signed August 30, 1951, by which the parties recognize that an armed attack in the Pacific Area on either of the Parties would be dangerous to its own peace and safety and each party agrees that it will act to meet the common dangers in accordance with its constitutional processes.

PARTIES: United States, Philippines

SOUTHEAST ASIA TREATY

A treaty signed September 8, 1954, whereby each party recognizes that aggression by means of armed attack in the treaty area against any of the Parties would endanger its own peace and safety and each will in that event act to meet the common danger in accordance with its constitutional processes.

PARTIES: United States , Australia, France, New Zealand, Philippines, Thailand, and the United Kingdom

JAPANESE TREATY (Bilateral)

A treaty signed January 19, 1960, whereby each party recognizes that an armed attack against either Party in the territories under the administration of Japan would be dangerous to its own peace and safety and declares that it would act to meet the common danger in accordance with its constitutional provisions and processes. The treaty replaced the security treaty signed September 8, 1951.

PARTIES: United States, Japan

REPUBLIC OF KOREA TREATY (Bilateral)

A treaty signed October 1, 1953, whereby each party recognizes that an armed attack in the Pacific area on either of the Parties would be dangerous to its own peace and safety and that each Party would act to meet the common danger in accordance with its constitutional processes.

PARTIES: United States, Korea

RIO TREATY

A treaty signed September 2, 1947, which provides that an armed attack against any American State shall be considered as an attack against all the American States and each one undertakes to assist in meeting the attack.

PARTIES: United States, Argentina, Bahamas, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru, Trinidad & Tobago, Uruguay, Venezuela

Provided by U.S. Department of State

Available for reference at www.state.gov/s/l/treaty/collectivedefense/

Appendix C
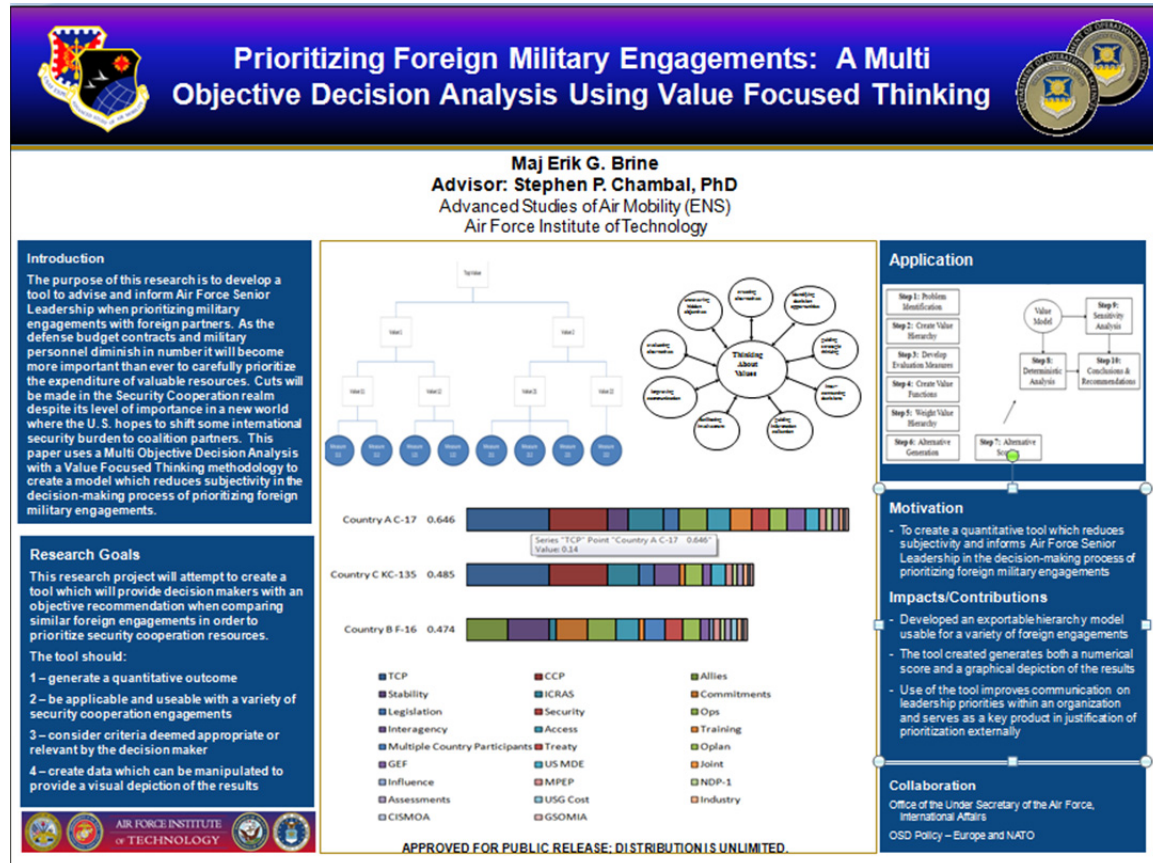
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14. ABSTRACT

The purpose of this research is to develop a tool to advise and inform Air Force Senior Leadership when prioritizing military engagements with foreign partners. As the defense budget contracts and military personnel diminish in number it will become more important than ever to carefully prioritize the expenditure of valuable resources. Cuts will be made in the Security Cooperation realm despite its level of importance in a new world where the U.S. hopes to shift some international security burden to coalition partners. This paper uses a Multi Objective Decision Analysis with a Value Focused Thinking methodology to create a model which reduces subjectivity in the decision-making process of prioritizing foreign military engagements.

The model is built using an Excel-based Hierarchy Builder add-on using input from SAF/IA and OSD Policy leaders to expose and weigh the many factors which comprise the value of a foreign military engagement. The tool provides a quantitative score and depicts the comparative results graphically which makes the end product easily absorbed by Senior Leaders and communicated to external agents.

15. SUBJECT TERMS
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